**We claim**

1. A data loading method in a communication system where subcarriers include eigenmodes, comprising:

estimating a channel matrix;

calculating a singular value decomposition of the estimated channel matrix for obtaining eigenvalue estimates;

defining biases between eigenvalues and eigenvalue estimates and performing a channel estimation reliability test based on the defined biases;

carrying out bias compensation for eigenvalue estimates based on the defined biases;

calculating equivalent power gain;

arranging eigenmodes into a predetermined number of clusters, each cluster comprising eigenmodes of different quality levels;

pre-allocating transmission power to the eigenmodes according to their capacity by using the calculated equivalent power gain;

determining collective transmission power to be allocated to each cluster based on the pre-allocation;

selecting the optimum modulation and coding scheme and allocating collective transmission power to the eigenmodes.

2. The method of claim 1, wherein the number of clusters is two and each cluster includes the strongest and the weakest eigenmodes of each subcarrier.

3. The method of claim 1, wherein the pre-allocation of transmission power is carried out by using water filling or modified water filling power allocation method.

4. The method of claim 1, wherein the communication system is a combined multiple-input-multiple output (MIMO) and orthogonal frequency division multiplexing (OFDM) system.

5.The method of claim 1, wherein the transmission power allocating to eigenmodes is started from the weakest cluster.

6. The method of claim 1, wherein the optimum modulation and coding scheme (MCS) which maximises the throughput under the total transmitted power and the maximum frame error rate (FER) constraints is found by using:

$$k_0 = \arg\max_{k=1,2,\dots,K} b_k \left( \max_{S\subset\{1,2,\dots,C\}:\sum_{c\in S}\bar{P}_c(\gamma_k)\le P} |S| \right) = \arg\max_{k} b_k s_k \, .$$

7. The method of claim 1, wherein the power required at the eigenmode $(i,c)$ in order to obtain a given target signal to noise ratio, $\mathrm{SNR}_t$, is given by:

$$\tilde{P}_{i,c}(\mathrm{SNR}_t) = \mathrm{SNR}_t \frac{N_0}{g_{i,c}} \quad .$$

8. The method of claim 1, wherein according to the modified water filling, the power to be pre-allocated for an eigenmode is expressed:

$$P_{i,c}^{(\mathrm{MWF})} = \min\left[\left(\mu - \frac{N_0}{g_{i,c}} G\right)^+, \frac{N_0}{g_{i,c}} \gamma_K\right].$$

9. The method of claim 1, wherein the powers allocated to the cluster's eigemodes are computed as follows:

$$P_{j_n} = \begin{cases} \tilde{P}_{j_n}(\gamma_{k_0}) = \gamma_{k_0} \dfrac{N_0}{g_{j_n}} & \text{if} \quad n \le s_{k_0} \\ 0 & \text{if} \quad n > s_{k_0} \end{cases} \quad .$$

10. The method of claim 1, wherein the clusters are encoded.

11. A transmitter of a communication system where sub-carriers are divided into eigenmodes, comprising:

means (300) for estimating a channel matrix;

means (302) for calculating a singular value decomposition of the estimated channel matrix for obtaining eigenvalue estimates;

means (304) for defining biases between eigenvalues and eigenvalue estimates and performing a channel estimation reliability test based on the defined biases;

means (304) for carrying out bias compensation for eigenvalue estimates based on the defined biases;

means (304) for calculating equivalent power gain;

means (304) for arranging eigenmodes into a predetermined number of clusters, each cluster comprising eigenmodes of different quality levels;

means (304) for pre-allocating transmission power to the eigenmodes according to their capacity by using the calculated equivalent power gain;

means (304) for determining collective transmission power to be allocated to each cluster based on the pre-allocation;

means (304) for selecting the optimum modulation and coding scheme and allocating collective transmission power to the eigenmodes.

12. The transmitter of claim 11, further comprising means (304) for pre-allocating transmission power by using water filling or modified water filling power allocation method.

13. The transmitter of claim 11, wherein the communication system is a combined multiple-input-multiple output (MIMO) and orthogonal frequency division multiplexing (OFDM) system.

14.The transmitter of claim 11, further comprising means (304) for allocating transmission power to eigenmodes starting from the weakest cluster.

15. The transmitter of claim 11, further comprising means (304) for searching for the modulation and coding scheme (MCS) which maximises the throughput under the total transmitted power and the maximum frame error rate (FER) constraints can be written as

$$k_0 = \arg\max_{k=1,2,\ldots,K} b_k \left( \max_{S\subset\{1,2,\ldots,C\}:\sum_{c\in S}\tilde{P}_c(\gamma_k)\le P} |S| \right) = \arg\max_k b_k s_k \ .$$

16. The transmitter of claim 11, wherein the power required at the eigenmode $(i,c)$ in order to obtain a given target signal to noise ratio, $\mathrm{SNR}_t$, is given by:

$$\tilde{P}_{i,c}(\mathrm{SNR}_t) = \mathrm{SNR}_t \frac{N_0}{g_{i,c}} \quad .$$

17. The transmitter of claim 11, wherein according to the modified water filling, the power to be pre-allocated for an eigenmode is expressed:

$$P_{i,c}^{(\mathrm{MWF})} = \min\left[\left(\mu - \frac{N_0}{g_{i,c}} G\right)^+, \frac{N_0}{g_{i,c}} \gamma_K\right].$$

18. The transmitter of claim 11, wherein the powers allocated to the cluster's eigemodes are computed as follows:

$$P_{j_n} = \begin{cases} \tilde{P}_{j_n}(\gamma_{k_0}) = \gamma_{k_0} \dfrac{N_0}{g_{j_n}} & \text{if} \quad n \le s_{k_0} \\ 0 & \text{if} \quad n > s_{k_0} \end{cases}.$$

19. The transmitter of claim 11, further comprising means (306A-306B) for encoding clusters.

20. A transmitter of a communication system where sub-carriers are divided into eigenmodes, configured to:

estimate a channel matrix;

calculate a singular value decomposition of the estimated channel matrix for obtaining eigenvalue estimates;

define biases between eigenvalues and eigenvalue estimates and performing a channel estimation reliability test based on the defined biases;

carry out bias compensation for eigenvalue estimates based on the defined biases;

calculate equivalent power gain;

arrange eigenmodes into a predetermined number of clusters, each cluster comprising eigenmodes of different quality levels;

pre-allocate transmission power to the eigenmodes according to their capacity by using the calculated equivalent power gain;

determine collective transmission power to be allocated to each cluster based on the pre-allocation;

select the optimum modulation and coding scheme and allocating collective transmission power to the eigenmodes.

21. A base station of a communication system where sub-carriers are divided into eigenmodes, comprising:

means (300) for estimating a channel matrix;

means (302) for calculating a singular value decomposition of the estimated channel matrix for obtaining eigenvalue estimates;

means (304) for defining biases between eigenvalues and eigenvalue estimates and performing a channel estimation reliability test based on the defined biases;

means (304) for carrying out bias compensation for eigenvalue estimates based on the defined biases;

means (304) for calculating equivalent power gain;

means (304) for arranging eigenmodes into a predetermined number of clusters, each cluster comprising eigenmodes of different quality levels;

means (304) for pre-allocating transmission power to the eigenmodes according to their capacity by using the calculated equivalent power gain;

means (304) for determining collective transmission power to be allocated to each cluster based on the pre-allocation;

means (304) for selecting the optimum modulation and coding scheme and allocating collective transmission power to the eigenmodes.

22. A base station of a communication system, where sub-carriers are divided into eigenmodes, configured to:

estimate a channel matrix;

calculate a singular value decomposition of the estimated channel matrix for obtaining eigenvalue estimates;

define biases between eigenvalues and eigenvalue estimates and performing a channel estimation reliability test based on the defined biases;

carry out bias compensation for eigenvalue estimates based on the defined biases;

calculate equivalent power gain;

arrange eigenmodes into a predetermined number of clusters, each cluster comprising eigenmodes of different quality levels;

pre-allocate transmission power to the eigenmodes according to their capacity by using the calculated equivalent power gain;

determine collective transmission power to be allocated to each cluster based on the pre-allocation;

select the optimum modulation and coding scheme and allocating collective transmission power to the eigenmodes.